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G2J JB7X16 JRC
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(56) Documents Cited
GB 2233785 A US 4946648 A US 3834263 A

(58) Field of Search
UK CL (Edition M) G2J JB7X16
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(54) Optical sight with part-reflective aspheric surface and mount

(57) An optical sighting device for providing an image of an aiming point in the line of sight of the user, comprises a transparent optical element 1 with a partially reflective aspheric surface.

An optical element containing a partially reflective aspherical surface may be made by placing a spherical sub-element in an aspheric cavity mould tool, injecting material into the cavity to provide an aspheric outer surface on the sub-element, coating the aspheric surface with reflective material and bonding another spherical sub-element to the first.

Transparent elastomeric material 8 is placed between relatively movable light source 2 and light transmitting optics 1 to provide a vibration resistant optical connection between them.

A mounting system for an optical sight comprises two shock absorbing portions 16.

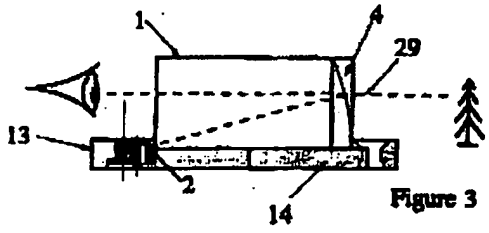

Figure 3

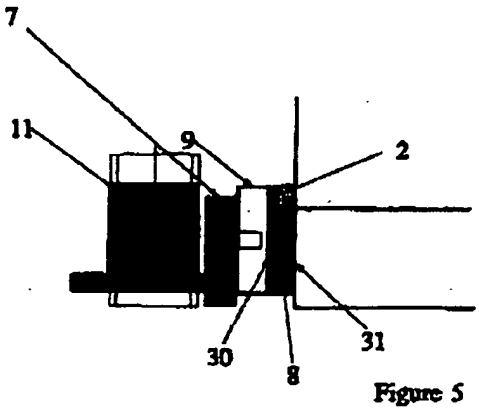

Figure 5

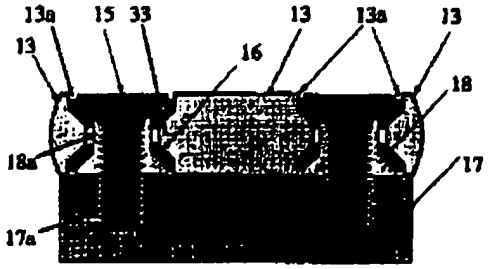

Figure 6

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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

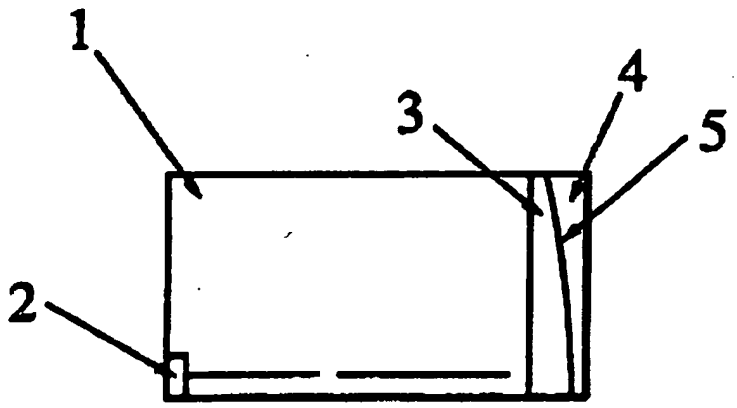

Figure 1

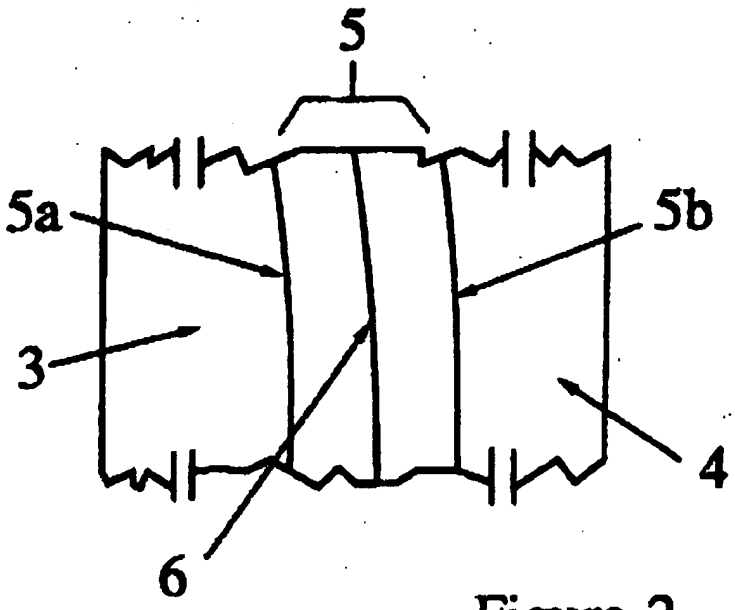

Figure 2

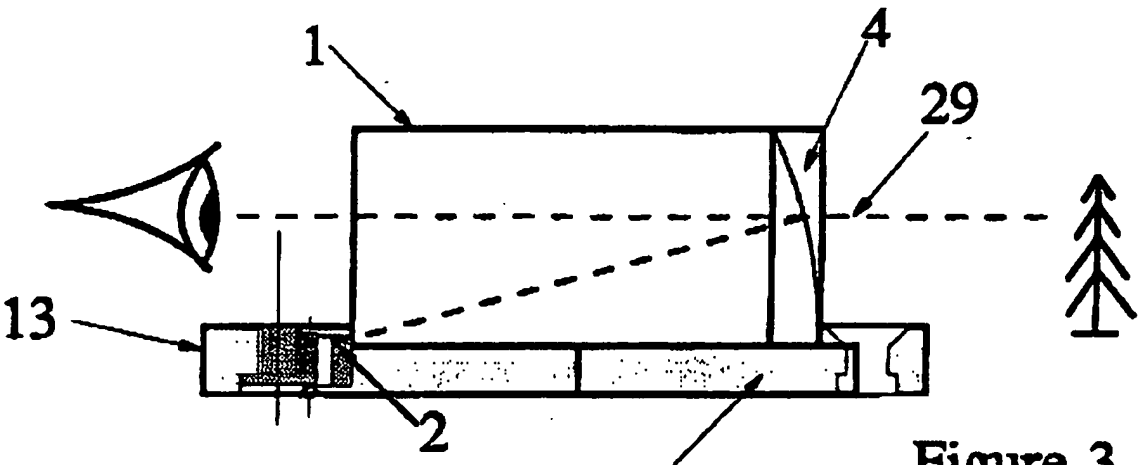

Figure 3

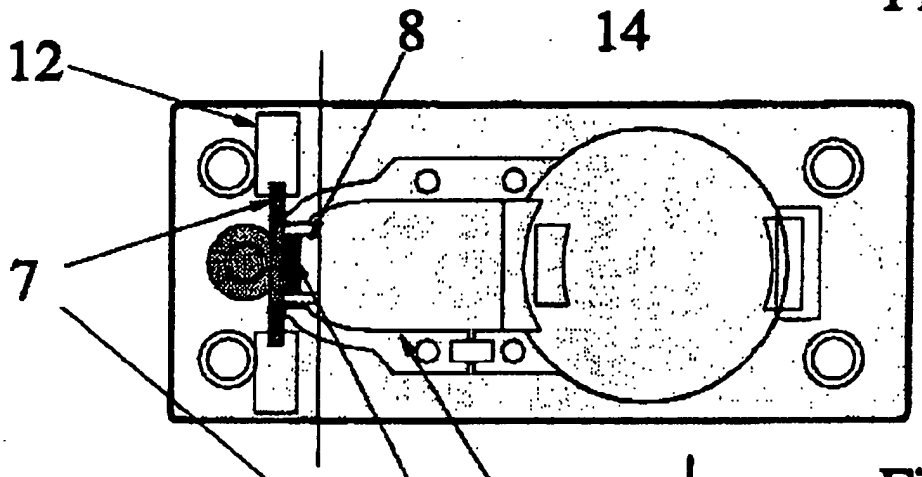

Figure 4

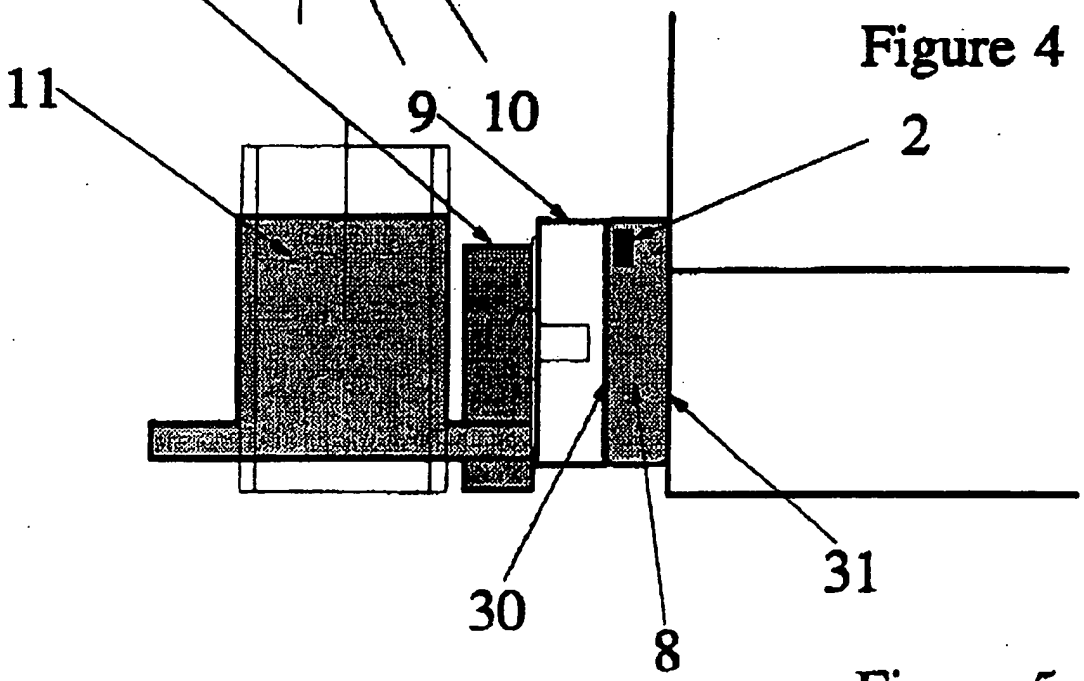

Figure 5

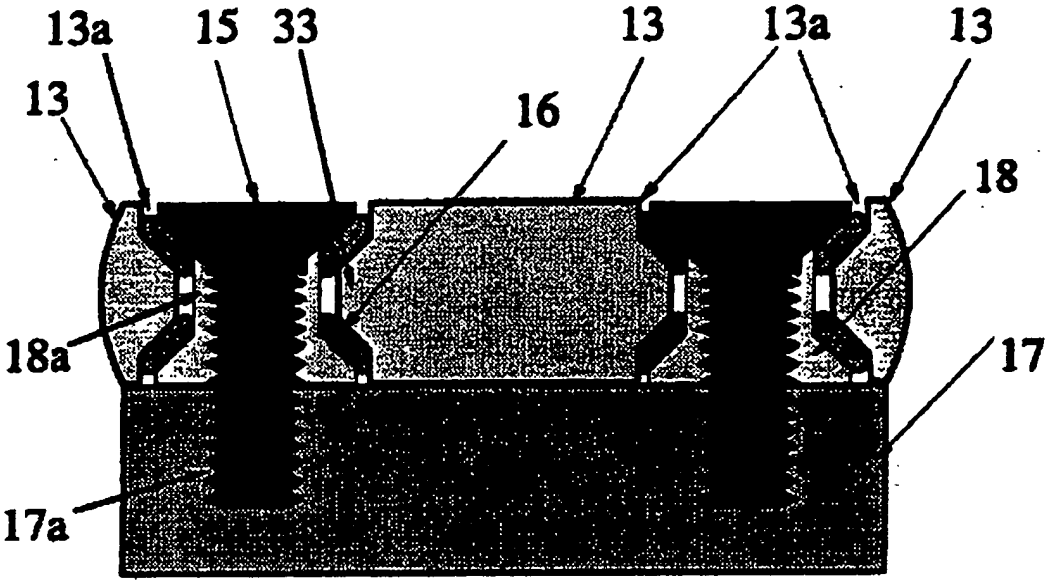

Figure 6

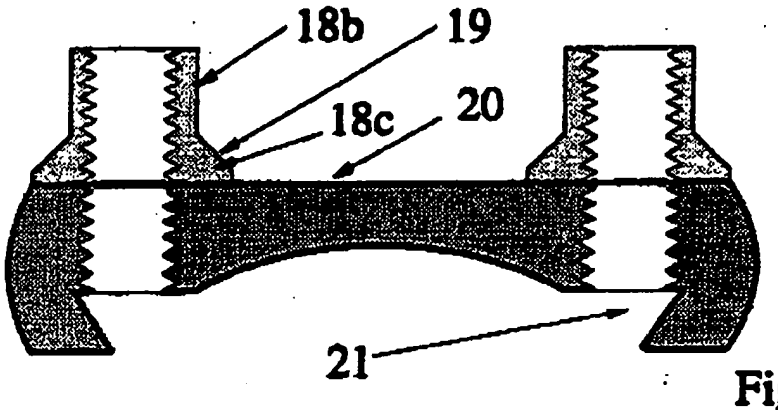

Figure 7

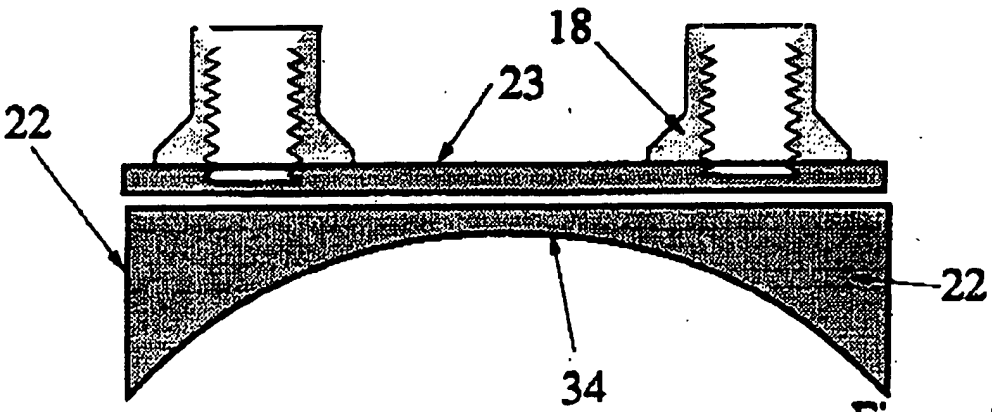

Figure 8

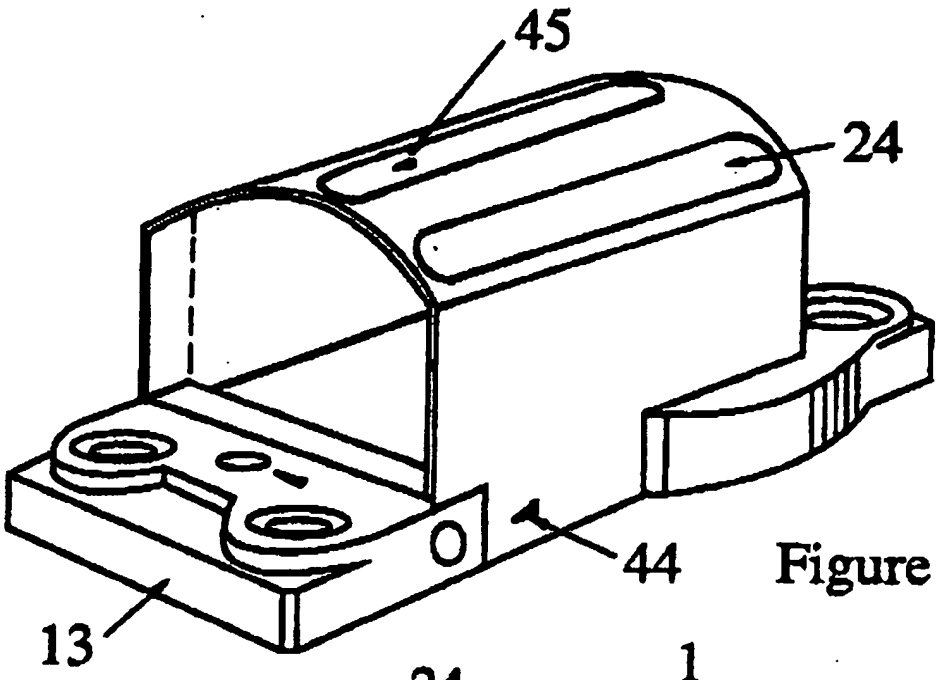

Figure 9

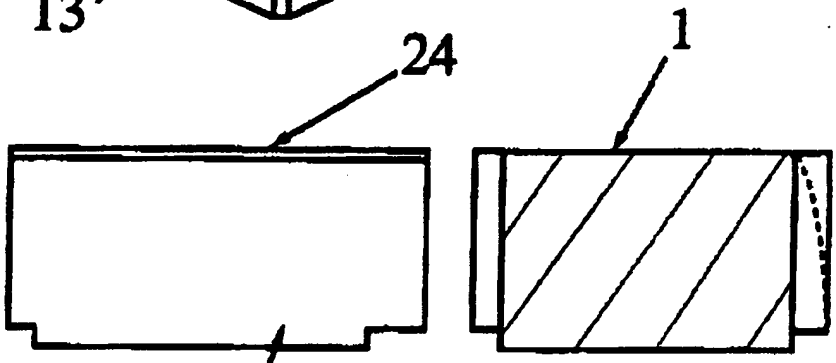

Figure 10

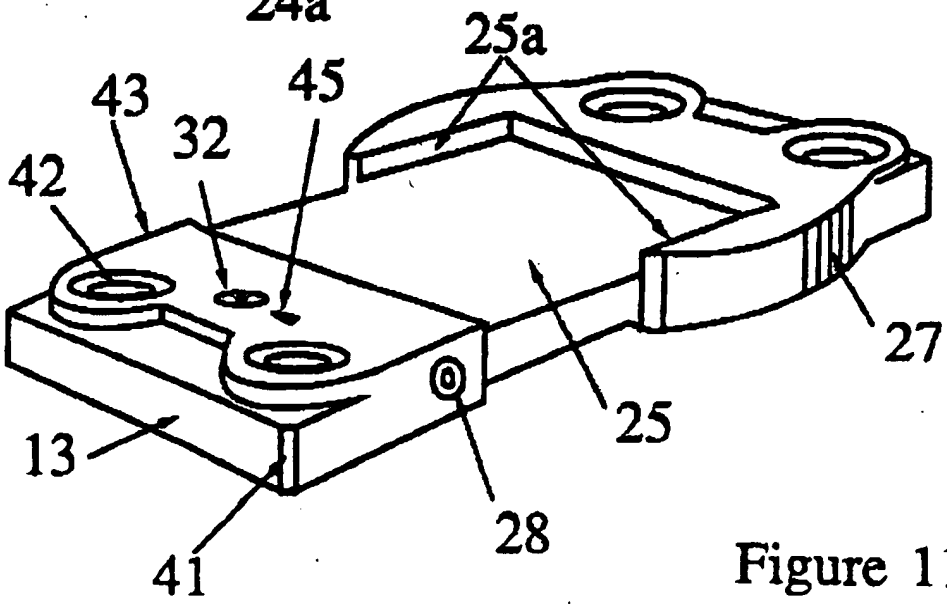

Figure 11

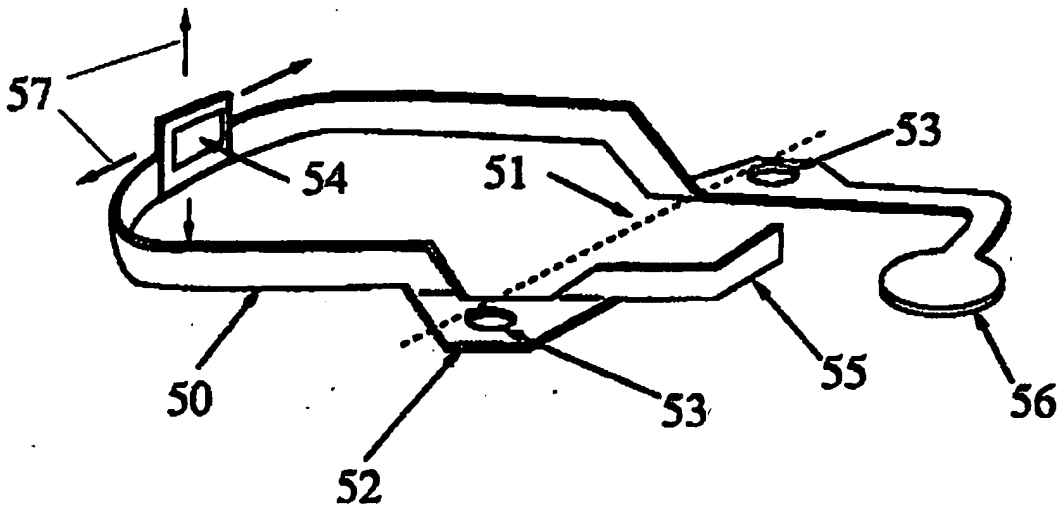

Figure 12

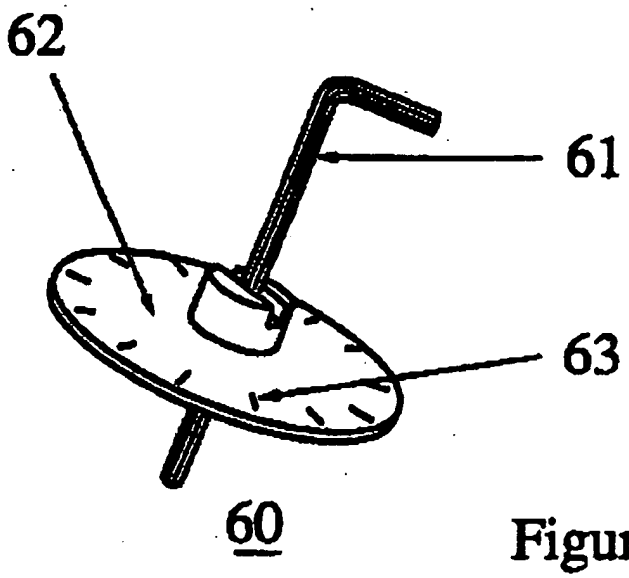

Figure 13

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"SIGHTING APPARATUS"

The invention relates to sighting devices such as gun sights or aiming devices, and more particularly, but not exclusively, to such sights in which a virtual image of an aiming point such as an illuminated spot or graticule pattern, apparently at infinity, is made to overlie the view of the target through the sight.

Such sights can be mounted to a handgun, rifle, shotgun or other small arm which includes bows, cross bows, paint guns and air/gas operated guns. The system can equally be used with other devices such as laser pointers, range finders and other equipment. Sights of this type are disclosed for example in U.S. Patent No. 4,390,276 and British Patents Nos. 2,049,118, 2,077,936 and 2,056,634. In sights of this type, the graticule is illuminated using incident light either from the target area, from the sky above, or from an adjacent artificial light source such as a Tritium Phosphor, or an LED. The graticule may either reflect the incident light or transmit the incident light to form the virtual image.

The target is viewed through the sight usually by means of a planar doublet reflector, or a similar combination of spherical lenses, which form a virtual image of the graticule superimposed on the view of the target. With such a spherical lens set, it is necessary to ensure that the angle formed between the light rays from the graticule which are reflected from a surface within the spherical lens set, and the optical axis of the lens set, is relatively small. This gives rise to relatively long focal lengths, otherwise spherical aberration will occur causing the graticule image to become blurred and parallax errors to become large. Typically focal length to aperture

ratios of 4:1 are used. This requirement causes the optical arrangement to become long compared to its aperture, and makes compact designs difficult. It is possible to avoid the problem of spherical aberration by using aspherical lens sets, but these are difficult and expensive to produce.

A further problem associated with this kind of sight occurs where the construction of the sight relies on the graticule or LED being bonded in direct contact with a solid optical transmission block occupying the space between the graticule and the partially reflecting mirror. With the prior art it is difficult to allow movement of the graticule relative to the optical block to facilitate zero adjustment. This is partly due to the requirement that good optical connection is maintained after movement, because measures such as gap-filling optical greases tend to migrate or to become contaminated, greatly impairing the optical connection. The sights tend to be subjected to severe vibration in service which also places the adjustment system under stress, causing drift in adjustment, or displacement of the graticule. Further problems are encountered if the graticule is an LED as the power supply to the device has to allow for movement of the LED during adjustment and during firing, e.g. by using flexible wires. These electrical connections tend to be fragile under such extreme conditions, and the connections can fail prematurely.

Current systems for mounting sights usually rely on a clamp system which can consist of clamp rings to hold a, usually cylindrical, optical sight onto either a dove tail mount or a rail on a gun, or directly into the frame/ slide or body of a hand gun. There are many variations on this type of mounting, but importantly the

connection or mounting is rigid. In some instances on hand guns particularly, the bracket or mount may be slightly flexible which gives some shock absorption between the gun and the sight. However the different characteristics in terms of recoil and vibration between various guns and sights makes the problem of reducing the shock imposed on a sight during firing very difficult. The resulting shock often causes premature failure of the sight.

A further feature of current mount systems is their size. In particular, on hand guns used in competition, powered red dot sight units have proved to be very effective. However, the mounts for this type of application increase the overall size, and while the sight aperture is preferred to be large, ideally the sight housing and mount need to be as compact as possible such that they obscure the field of view as little as possible.

The wide variation in the type of mounting system for different applications and the many different manufacturers, means that there is very little standardisation. This in turn means that mounts are specifically made for a particular application, which usually means individual guns have to be machined to accept a type of mount. This is both expensive and time consuming, and once done the gun cannot be returned to the original condition economically.

It is an object of the present invention to overcome, or at least to reduce one or more of the problems outlined above.

According to a first aspect of the present invention, there is provided an optical sighting apparatus for providing an image of an aiming point in the line of sight of the user, comprising an optical element made of a transparent material with a partially reflective

surface incorporated therein for reflecting into the line of sight light derived from an illuminated source, wherein said reflective surface is aspherical. Thus it can provide an unmagnified view of the target with an illuminated aiming point.

Preferably, the reflective surface provides a virtual image, focused at infinity, at the aiming point. It is advantageous to use a system where the dot is always parallel to the barrel or bullet trajectory and can be used either in the middle or extreme edges of the optic. This provides a sight which is easy to use as the eye can be any distance behind the optic and both eyes can be kept open, greatly increasing the target scene awareness and improving hit probability. By using a thin protective shield around the sight optics the illuminated aiming point appears to be an "open" dot floating above the gun as the visible cross-section of the shield is very small when looking at the target area. This provides the advantage of a large viewing area similar to a laser pointer but with the extra advantage of the "open" dot being visible regardless of the ambient light level, range or background and uses an almost negligible amount of power in comparison. It is also preferable that the reflective surface has a short focal length and selectively reflects light in a narrow bandwidth. It is therefore advantageous to use a light emitting diode, in particular a quaternary monolithic LED, to provide the illuminated source. The Quaternary Monolithic LED has a four element (In.Al.Ga.P) structure, which allows a specific shape of the light emitting area to be defined, (e.g. a spot or a cross), which is very small e.g. for a spot having a diameter of some 0.025 mm or thereabouts. Normal LED's have a square emitting area with a gold bond connection in the centre

These LED's then have a mask or hole placed over them to produce an aiming point of the right size without viewing the gold wire going to the centre of the emitting area. In the invention the small area coupled with the very high efficiency of the LED causes electrical current consumption to be dramatically reduced. The LED may be a laser diode.

To allow for movement of the LED during adjustment and firing, the substrate may be mounted on sprung support with battery connections forming the arms of the spring. The support would be preferably made from a stainless steel strip which is light yet strong. This allows the unit to be powered by its own internal power source without dramatically affecting the size or weight of the unit.

The small distance of the light emitting area is made possible by the short focal length of the aspheric reflector. Typically a focal length to aperture ratio of better than 1:1 is used. The reflector may be adapted to reflect selectively the narrow bandwidth of light that is emitted from the LED rather than the general broad bandwidth of visible light that makes up the viewed target area. This may be achieved by using a Dichroic coating, which comprises several layers of metals and oxides to produce a very thin layer which is selectively used to reflect different wavelengths whilst allowing transmission of other wavelengths. The coating is applied using vapour deposition of various materials such as magnesium fluoride and titanium dioxide in a high vacuum. This results in high transmission of light from the target area to the operator through the optical system, and a high efficiency of reflection of the light from the LED. This provides a compact unit with good transmission of light from the target whilst maintaining low power consumption. To produce the virtual image, a true or off axis parabolic aspherical reflective surface which avoids spherical

aberration and parallax errors may be used. Such an aspherical reflective surface may be constructed in a meniscus layer between two sub-elements having corresponding spherical surfaces.

The spherical lens set that contains the aspherical reflecting surface may be constructed from glass or a similar material, which gives rigidity and strength to contain the acrylic/polyester polymer meniscus layer which in turn encapsulates the aspheric reflecting surface.

The meniscus layer containing the aspheric surface may be so designed so it does not have to have the same refractive index as the surrounding supporting transparent material. However, although this does not distort the image of the target area as the polymer is comprised of a meniscus of constant thickness, when the reflector reflects the image of the aiming point, the light passes through only part of the meniscus layer which is not of constant thickness and will therefore suffer a distorting effect. This can be rectified by modifying the shape of the reflecting surface to something other than a parabolic reflector. The supporting elements may have plano-spherical surfaces which are designed to optically counteract each other when assembled.

The surfaces of the sub-elements opposite the aspherical surfaces are planar, but may be curved.

The spherical lens set, which contains the reflector, may be mounted onto a polymer optical block to reduce weight. The net effect is to have a compact, light weight, internally powered optical assembly which contains an aspheric reflecting element which can be manufactured simply and at low cost.

It is advantageous when manufacturing an optical element containing a partially reflective

aspherical surface to use a method comprising the steps of: forming two spherical sub-elements, at least one having a main portion onto the spherical surface of which a layer is to be applied; placing the spherical surface of the sub-element into an aspheric cavity mould tool and injecting material into the cavity between the spherical sub-element and the aspherical mould to provide a layer forming an aspherical outer surface of the sub-element; coating the aspherical surface of the sub-element with a reflective material; and bonding the second sub-element to the first. This is referred to as a replicated aspheric meniscus (RAM).

According to a second aspect of the present invention, there is provided an optical device comprising a light source and light transmitting optics, the light source being movable relative to the optics, and including a body of transparent elastomeric material interposed between said light source and optics to provide a vibration resistant optical connection between the light source and the optics to allow small relative movement between said light source and said optics without sliding occurring between said elastomeric body and said optical means.

It is advantageous when constructing such an optical device to encapsulate the light source in the elastomeric body though it may be separated from the optical block by an elastomeric element which is separate. It is also advantageous that the substrate to which the light source is mounted, is bonded to the body of the elastomeric material. It is also beneficial for the elastomeric body to be able to slide relative to the optical means, to allow larger relative displacements during zero adjustment of the sight.

For such larger movements of the LED the surfaces slide part of the distance, then slowly creep the remainder of the distance as the elastomeric strain is

relieved. The deformation of the elastomeric block is very small (around 2° maximum) and therefore does not affect the optical characteristics.

Wherein the contacting surfaces of the elastomeric body and the optical means may be coated with an optically transparent lubricant such as silicon oil which remains effective for extended periods of use without migration or contamination. Vibration between the components is absorbed by the elastomeric element and the surfaces remain in optical contact.

This provides an adjustment system, which allows backlash free adjustment and positive locking of the new position.

The illuminated source used may be a light emitting diode such as a monolithic LED.

According to a third aspect of the present invention, there is provided a mounting system for an optical sighting apparatus whereby the optical sight apparatus is supported by being gripped between two shock absorbing portions.

The shock absorbing portions may be made of an elastomeric material. The body of the sighting apparatus, advantageously has at least one protrusion sandwiched between the shock absorbing portions and may have angled sides which are in contact with the shock absorbing portions. The shock absorbing portions may be held in position by supporting means which may comprise a shoulder portion and a fastening portion removably attached to the shoulder portion so that all the pieces of the sight are held together when removed from the gun. Preferably said shoulder portions and said fastening portions have an inclined portion in contact with said shock absorbing portion.

The protrusion may comprise an internal diameter reducing rib in the hole in the body of the sighting apparatus with the supporting means extending through the hole. It is also beneficial for the rib to have bevelled upper and lower edges to form the inclined portions against which the shock absorbing portions are in contact so as to grip the rib between the fastening portions and the shoulder portions. The inclined portions of the rib and said shock absorbing portions may be annular. In this case the shock absorbing portions may comprise circular O-rings, which are readily available or alternatively specially moulded elastomers.

Advantageously, the shoulder portion is provided on the outside of a generally cylindrical body having an axial bore through which the fastening portion extends and wherein said fastening portion may be a screw. To be able to adjust the rigidity of mounting shock absorbing portions of different elasticity may be used. It is advantageous to be able to attach said fastening portion either directly to a device requiring a sight, or either directly on or indirectly to an interface mount which is fastened to a device requiring a sight.

This provides within the mount itself a system to isolate vibration and shock being transmitted from the gun to the sight, and that the system of isolation can be adjusted to maximise its effectiveness.

It is also desirable that the mount is extremely compact and that the mount system can be contained within the sight itself.

A further feature of the invention is that the mount is very adaptable and the mount can be fitted directly to a gun by machining screw fixings to the gun, or an interface clamp can be used to attach to an existing

feature on the gun such as a dovetail. Alternatively, the mount can be fitted to a very low profile adaptor plate that is bonded to the gun, but which can be removed if need be, without marking the gun. This feature is extremely useful where there is no dove tail for example and there are no machining facilities available, the gun can be adapted to take the sight mount under field conditions.

It is envisaged that the different aspects of the invention can be advantageously combined.

The apparatus in accordance with the present invention and its method of operation will now be described by way of example only, with reference to the accompanying drawings, in which:

Figure 1 shows a sectional view of the optical apparatus.

Figure 2 shows an enlarged view of the aspherical reflecting surface sandwiched between the two spherical elements.

Figure 3 shows a side view of the sight apparatus.

Figure 4 is a plan view of the sight apparatus showing the layout of the adjustment system.

Figure 5 is an enlarged view of the elevation adjustment system.

Figure 6 shows the layout of the mount system in position on a gun.

Figure 7 shows the shoulder portions attached to an adaptor which can be used to attach to a dovetail feature on a gun.

Figure 8 shows the support portions being fastened to a thin plate for attachment by bonding to an interface mount.

Figure 9 is a perspective view of the preferred

embodiment of the present invention.

Figure 10 shows the outer cover and optical assembly.

Figure 11 is a perspective view of the base portion of the sight.

Figures 12 and 13 show further parts of the apparatus.

Figure 1 shows the layout of the optical arrangement in this example. It shows an optical block of transparent refractive material 1 to which the other elements are bonded. These elements are an LED light source 2 on the rear face which is aligned with the centre of the optical axis of spherical elements 3 and 4 on the front but lying below the line of sight to the target so the LED and circuit does not obscure the view of the target. The LED 2 also lies at the focal point of an aspheric reflecting surface 6, contained in a meniscus layer 5 provided between the spherical elements 3 and 4.

Figure 2 shows a closer view of the meniscus layer 5 in which the aspherical reflecting surface 6 lies. The meniscus layer comprises three parts, 5a, 5b and 6. The aspheric reflecting surface 6 is formed using a technique called replication in which spherical optical elements are modified to a desired shape by casting onto one of their surfaces a transparent polymer layer, using an accurate cavity mould tool. The optical element 34 is placed into the mould and the space between the optic and the mould tool is filled with polymer material. The polymer is cured usually using UV light and then the optical element is removed from the mould. In this particular application the technique is to use an aspheric mould tool to form a polymer profile on the surface of one of the

spherical elements. The polymer layer then has a suitable material applied to it to act as a reflector. The second spherical element is then bonded to the first element using the same polymer material. In the present invention, a thin layer of polymer 5a is applied to the spherical surface of the optical element 3 in a varying thickness to give an aspherical outer surface. The reflective layer 6 is applied to the aspherical surface and then the second optical element 4 is bonded to the reflective surface using the same polymer material to form the second layer 5b. The resultant composite is a thin meniscus polymer laminate 5 between two spherical optical elements 3,4 generally made of glass containing a reflective aspheric surface 6.

Consequently light from the LED light source 2 is reflected back towards the user along the line of sight producing the effect of a virtual aiming point focused at infinity and without the spherical aberration problems mentioned above.

Figure 3 shows a sectional side view of the sighting apparatus. Here the dashed lines show the line of sight of the user and the path of the light reflected from the LED 2 by the aspherical surface 6. The mount for the LED 2 and also zero adjustment apparatus is shown in Figure 3 and 4 and in detail in Figure 5.

Figure 5 shows the LED 2 encapsulated within an elastomeric optical element 8. The block of elastomeric material 8 is bonded on its surface 30 to a substrate 9 on which the LED is mounted. The opposite surface 31 of the elastomeric block is pressed against the solid optical element 1 making an optical connection between them. This construction allows small relative movements of the LED 2 in relation to the optical block 1, parallel to the surface of the optical block 1, without the contact surface between

the elastomeric element 8 and the optical block 1 having to slide. Therefore vibrations, caused by the high G forces generated during use of the gun, are absorbed by the elastomeric element 8 and the surface of the elastomeric element remains in contact with the optical block 1 maintaining optical contact throughout.

To provide the zero adjustment of the sight after mounting and testing, the LED substrate 9 is movable up and down and left and right using the respective adjustment screws 32 and 28. A locking screw 43 on the opposite side to the adjustment screw 28, is used to lock the adjustment mechanisms 28, 32 once the desired position has been achieved. To adjust the zero-setting the locking screw 43 is released then the adjustment screws 28 and 32 are rotated by an adjustment tool 60 as shown in Figure 13. The tool 60 comprises an allen key 61 with a radially marked disc 63 fitted over it the marks 63 being used to precisely determine the movements left/right and up/down, by use of reference points 44,45 on the top and side of the sight. Once the adjustments have been made the locking screw is returned to the locked position.

For relatively small movements of the LED relative to the optical block the elastomeric material will deform but will not slide relative to the optical block.

During larger movements of the LED 2, relative to the optical block, the surface 31 of the elastomeric material 8 slides relative to the surface of the optical block 1. This is aided by a silicon oil film which coats the contacting surfaces. Once the movement is stopped the elastomeric material 8 which will still be under an elastomeric strain will slowly recover its shape with time as the strain is relieved through creep. This provides an adjustment system with no backlash and positive locking of

the new position.

Once the sight has been adjusted and aligned, the adjustment system 28,32 is fixed. Figure 12 shows the mounting for the substrate of the LED. The electrical connections are constructed from a stainless steel strip, bent to form a spring portion 50 which allows movement of the LED substrate 54 both up and down and left to right 57.

The strip is fixed to the mount using fixing holes 53 allowing bending to take place along the line 51. The two fixing points are further connected to battery contacts 55, 56. This provides electrical connection to the LED which is light and flexible yet also very strong, providing a long operating life.

Figure 6 shows the layout of the mounting systems according to the present invention. The base 13 of the sight includes four holes 13a, one in each corner, each hole 13a has about half way down an annular rib or diameter-reduced portion 33. The upper and lower edges of the rib 33 are bevelled 42. The base is mounted to a gun 17 via corresponding threaded holes 17a.

In each of the holes 13a in the base is provided a shouldered support 18 each having a central threaded bore 18a and an upper cylindrical portion 18b and a lower flared portion 18c providing a shoulder 19 onto which a circular elastomeric shock absorber or 'O'-ring 16 is placed. The holes in the base portion 13 receive the cylindrical portion 18b of the shouldered supports so that the lower bevel of the rib 33 in the hole comes to rest on the elastomeric shock absorber 16. A second similar shock absorber is placed on the upper bevel of the rib in each of the holes in the base 13. Finally a screw 15 is passed through each hole 13a and screwed into the threaded holes

17a in the gun. Each screw has a countersunk head to push the uppermost shock absorber onto the annular rib 33. Thus the head of the screw and the shoulder 19 of the shouldered portion grip the base 13 through the shock absorbers 16 and support it.

The pre-load on the shock absorbers can be adjusted by varying the height of the shouldered portion 18. The gap between the sight base 13 and the gun 17 can be adjusted by using different sizes of shock absorbers on the top and bottom. By using different grades of elasticity the response features of the shock absorbers can be varied.

In an alternative embodiment instead of screwing the sight directly to the body of the gun, it is screwed to an adaptor 20 having a dovetail mount 21. The adaptor can then be used for mounting on the on a gun.

In a yet further embodiment the sight is attached to a base plate 23. This plate is then attached to an interface mount 22 by appropriate fastening means such as bonding, using a toughened acrylic adhesive.

The interface mount has an attachment face 34 which is made appropriately flat or curved to match the gun surface it is in turn attached to. This may also be attached by bonding.

The interface mounts are manufactured from engineering polymers which are selected for their toughness and their ability to be bonded to each other and to a gun. This allows them to be cut-off with a knife or to be machined off the gun should the mounting be required to be permanently removed. This would leave the gun in its original condition as opposed to previous methods of sight mounting which require practically irretrievable machining of the gun.

Figure 11 shows a perspective view of the base B of the sight. The optical block is located in the depression 25 and the protective shield 24, which is made from a thin (0.5-0.6mm) layer of titanium or similar material, is positioned over the top. The lower portions of the shield 24 are then bonded to the base 13 along the lips 25a. The bulge 26 on the side of the base 13 provide a space for the power source. Knurling on the surface of the bulge 26 provides the user with grip for racking the slide back when used on a semi-automatic pistol.

CLAIMS

1. An optical sighting apparatus for providing an image of an aiming point in the line of sight of the user, comprising an optical element made of a transparent material with a partially reflective surface incorporated therein for reflecting into the line of sight light derived from an illuminated source, wherein said reflective surface is aspherical.

2. An optical sighting apparatus according to claim 1, wherein the image produced is focused at infinity.

3. An optical sighting apparatus according to claims 1 or 2, wherein the reflective surface has a short focal length.

4. An optical sighting apparatus according to any of claims 1 to 3, wherein said illuminated source is a monolithic light emitting diode or a laser diode.

5. An optical sighting apparatus according to claim 4, wherein the reflective surface is adapted to reflect selectively the narrow bandwidth of light that is emitted by the LED or laser diode.

6. An optical sighting apparatus according any one of claims 1 to 5, wherein said optical element comprises a replicated aspherical reflective surface.

7. An optical sighting apparatus according to claim 6, wherein at least one of the sub-elements forming the replicated aspherical reflective surface has a main portion constructed so as to have a spherical surface.

8. An optical sighting apparatus according to claim 6 or 7, wherein said main portion of said sub-element is composed of glass.

9. An optical sighting apparatus according to

claims 7 or 8, wherein said spherical surface of said sub-elements has a layer of variable thickness applied to said spherical surface such that the outer surface of said layer is aspherical.

10. An optical sighting apparatus according to claim 9, wherein said aspherical surface of said variable thickness layer has a parabolic shape.

11. An optical sighting apparatus according to claims 9 or 10, wherein said variable thickness layer is composed of a polymer.

12. An optical sighting apparatus according to any of claims 9 to 11, wherein the refractive index of the variable thickness layer is the same as that of said main portion of said sub-elements.

13. An optical sighting apparatus according to any of claims 7 to 12, wherein said spherical surfaces of said sub-elements are shaped so as to optically counteract each other.

14. An optical sighting apparatus according to any of claims 1 to 13, wherein the optical element is mounted adjacent to an optical block which may be constructed of a polymer.

15. An optical sighting apparatus according any of claims 1 to 14, wherein the surfaces of the sub-elements opposite to the aspherical surface are planar.

16. A method of manufacturing an optical element containing a partially reflective aspherical surface comprising the steps of:

forming two spherical sub-elements, at least one having a main portion onto the spherical surface of which a layer is to be applied;

placing the spherical surface of the sub-element into an aspheric cavity mould tool and injecting

material into the cavity between the spherical sub-element and the aspherical mould to provide a layer forming an aspherical outer surface of the sub-element;

coating the aspherical surface of the sub-element with a reflective material; and

bonding the second sub-element to the first.

17. An optical sighting apparatus including an optical element made by the method of claim 16.

18. An optical sighting apparatus substantially as hereinbefore described with reference to and as illustrated in Figures 1, 2, 9 and 10 of the accompanying drawings.

19. An optical device comprising a light source and light transmitting optics, the light source being movable relative to the optics, and including a body of transparent elastomeric material interposed between said light source and optics to provide a vibration resistant optical connection between the light source and the optics to allow small relative movement between said light source and said optics without sliding occurring between said elastomeric body and said optical means.

20. An optical device according to claim 19, wherein the light source is embedded in the elastomeric body.

21. An optical device according to claim 19 or 20, wherein the side of the body of elastomeric material opposite to that contacting the optical means is bonded to a substrate to which the light source is mounted.

22. An optical device according to claim 19, 20 or 21, wherein sliding may occur between said elastomeric body and optical means as a result of large displacements of the light source relative to the optical means.

23. An optical device according to any one of claim 19 to 22, wherein said light source is a light emitting diode or a laser diode.

24. An optical device according to any one of claims 19 to 23, wherein the surfaces of the contacting surfaces of the elastomeric body and optical means are coated with an optically transparent lubricant such as a silicon oil.

25. An optical device substantially as hereinbefore described with reference to and as illustrated in Figures 3, 4, 5, 9 and 11 of the accompanying drawings.

26. A mounting system for an optical sighting apparatus whereby the optical sight apparatus is supported by being gripped between two shock absorbing portions.

27. A mounting system according to claim 26, wherein the shock absorbing portions are made of an elastomeric material

28. A mounting system according to claims 26, or 27, wherein the body of the sighting apparatus has at least one protrusion sandwiched between said shock absorbing portions.

29. A mounting system according to claim 28, wherein said protrusion has angled sides which are in contact with said shock absorbing portions.

30. A mounting system according to any of claims 26 to 29, wherein said shock absorbing portions are held in position by a supporting means.

31. A mounting system according to claim 30, wherein said supporting means comprises a shoulder portion and a fastening portion removably attached to said shoulder portion.

32. A mounting system according to claim 31, wherein said shoulder portion has an inclined portion in contact with said shock absorbing portion.

33. A mounting system according to claim 31 or 32, wherein said fastening portion has an inclined portion in contact with said shock absorbing portion.

34. A mounting system according to any of claims 32 to 33, wherein the protrusion comprises an internal diameter reducing rib in a hole in the body of the sighting apparatus, said supporting means extending through the hole.

35. A mounting system according to any of claims 32 to 34, wherein the rib has bevelled upper and lower edges to form said inclined portion, the lower edge being supported on said shoulder portion via one of said shock absorbing portions and said upper edge carrying another shock absorbing portion which is in contact with the inclined edge of the fastening portion, whereby said rib is gripped between the fastening portion and the shoulder portion via the shock absorbing portion.

36. A mounting system according to any of claims 32 to 35, wherein said rib, inclined portion and said shock absorbing portions are annular.

37. A mounting system according to any of claims 31 to 36, wherein said shoulder portion is provided on the outside of a generally cylindrical body having an axial bore through which the fastening portion extends.

38. A mounting system according to any of claims 31 to 37, wherein said fastening portion is a screw.

39. A mounting system according to any of claims 31 to 38 wherein a portion of said fastening portion is fastenable to a device requiring a sight.

40. A mounting system according to any of claims 26 to 29, wherein the shock absorbing portions can be made of different elasticity to alter the rigidity of mounting.

41. A mounting system according to any of claims 31 to 40, including an adaptor to which said fastening portion is fastenable, the adaptor being attachable to a device requiring a sight.

42. A mounting system according to any of claims 31 to 40, wherein said fastening portion is fastenable to an interface mount, said interface mount comprising a surface which matches the surface of a device requiring a sight.

43. A mounting system according to claim 42, wherein said interface mount comprises: an adaptor plate with a flat surface, said adaptor plate being fastenable to said fastening portion; a second part having a surface which matches the surface of a device requiring a sight and a flat surface for attachment to said adaptor plate fastenable to said device requiring a sight.

44. A mounting system as hereinbefore described with reference to and as illustrated in Figures 6, 7, 8, 9 and 11 of the accompanying drawings.

45. An optical sighting apparatus according to any of claims 1 to 18, and/or further comprising the features of any of the claims 19 to 25, and/or the features of any of claims 26 to 44.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report)	Application number GB 9404012.8
Relevant Technical Fields (i) UK Cl (Ed.M) G2J (JB7X16) (ii) Int Cl (Ed.5) G02B	Search Examiner MR C J ROSS Date of completion of Search 21 APRIL 1994
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii)	Documents considered relevant following a search in respect of Claims :- 1-15

Categories of documents

X:	Document indicating lack of novelty or of inventive step.	P:	Document published on or after the declared priority date but before the filing date of the present application.
Y:	Document indicating lack of inventive step if combined with one or more other documents of the same category.	E:	Patent document published on or after, but with priority date earlier than, the filing date of the present application.
A:	Document indicating technological background and/or state of the art.	&:	Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2233785 A	(PILKINGTON) See especially Page 8 Line 3 on	1 at least
X	US 4945646	(EKSTRAND) See especially column 7 Line 2-3	1 at least
X	US 3836263	(RICKERT) See especially column 2 Line 50 on	1 at least

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PATENT COOPERATION TREATY

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INTERNATIONAL SEARCH REPORT

(PCT Article 18 and Rules 43 and 44)

Applicant's or agent's file reference W 576-040 Sm	FOR FURTHER ACTION	see Notification of Transmittal of International Search Report (Form PCT/ISA/220) as well as, where applicable, item 5 below.
International application No. PCT/SE 99/02482	International filing date *(day/month/year)* 27 December 1999	(Earliest) Priority Date *(day/month/year)* 15 July 1999
Applicant GS Development AB		

This international search report has been prepared by this International Searching Authority and is transmitted to the applicant according to Article 18. A copy is being transmitted to the International Bureau.

This international search report consists of a total of 2 sheets.

[X] It is also accompanied by a copy of each prior art document cited in this report.

1. [ ] Certain claims were found unsearchable (See Box I).

2. [ ] Unity of invention is lacking (See Box II).

3. [ ] The international application contains disclosure of a nucleotide and/or amino acid sequence listing and the international search was carried out on the basis of the sequence listing
   - [ ] filed with the international application.
   - [ ] furnished by the applicant separately from the international application,
     - [ ] but not accompanied by a statement to the effect that it did not include matter going beyond the disclosure in the international application as filed.
   - [ ] transcribed by this Authority.

4. With regard to the title,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established by this Authority to read as follows:

5. With regard to the abstract,
   - [X] the text is approved as submitted by the applicant.
   - [ ] the text has been established, according to Rule 38.2(b), by this Authority as it appears in Box III. The applicant may, within one month from the date of mailing of this international search report, submit comments to this Authority.

6. The figure of the drawings to be published with the abstract is:
   Figure No. 1
   - [X] as suggested by the applicant.
   - [ ] because the applicant failed to suggest a figure.
   - [ ] because this figure better characterizes the invention.
   - [ ] None of the figures.

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE 99/02482

A. CLASSIFICATION OF SUBJECT MATTER

IPC7: F41G 1/30
According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: F41G

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	SE 449262 B (SCAN COIN AB), 13 April 1987 (13.04.87) --	1-13
A	US 5452131 A (R. JÖRLÖV), 19 Sept 1995 (19.09.95) --	1-13
A	US 5594584 A (I.M. KAY ET AL), 14 January 1997 (14.01.97) --	1-13
A	US 5625954 A (A.C. DEPAOLI), 6 May 1997 (06.05.97) --	1-13

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" erlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
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"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
3 May 2000	15-05-2000
Name and mailing address of the ISA/ Swedish Patent Office Box 5055, S-102 42 STOCKHOLM Facsimile No. +46 8 666 02 86	Authorized officer Åke Olofsson / MR Telephone No. +46 8 782 25 00

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Information on patent family members

02/12/99

International application No.
PCT/SE 99/02482

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
SE 449262 B	13/04/87	SE 8602518 D ✓	00/00/00
US 5452131 A	19/09/95	AU 674035 B	05/12/96
		AU 5288093 A	09/05/94
		BR 9307224 A	25/05/99
		EP 0663971 A	26/07/95
		FI 951739 A	12/04/95
		GB 2276015 A,B	14/09/94
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		SE 500372 C	13/06/94
		SE 9300782 A	13/06/94
		US 5607548 A	04/03/97
US 5594584 A	14/01/97	NONE	
US 5625954 A	06/05/97	NONE	